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AUTHOR Grant, C. A.; Scott, T. M.
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ABSTRACT

Electronic technology and high-speed communications are no longer simply aids to collaborative working. In this information era, information that is speedy, accurate and in a form that enables people to make decisions and work productively together across geographical distances is the key to cost-effective efficient collaboration. This paper looks at how Advanced Communication Technologies are revolutionaizing the way collaborative teams can work together. It represents great opportunities for collaboration in the fields of research, commerce and education. In particular, the paper discusses how electronic collaboration is becoming an essential component of business and university life, and how Internet technology is being recognized as a powerful new means to improve the productivity of working groups. High-speed communication networks are a powerful tool for promoting successful international partnerships. Using high-speed bandwidth to communicate, collaborative research and development work can be progressed efficiently (without waiting until the next scheduled meeting). This paper illustrates how the authors have gained advantage by exploiting current technology to form successful partnerships in this new, high-speed information age. (Contains 20 references.) (Author)

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The 'Superhighway': A Revolutionary Means of Supporting Collaborative Work

By:

C.A. Grant

T.M. Scott

U.S. DEPARTMENT OF EDUCATION
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The 'superhighway': a revolutionary means of supporting collaborative work

C.A. Grant and T.M. Scott
University of Ulster, UK

Abstract: *This paper looks at how Advanced Communication Technologies are revolutionising the way collaborative teams can work together. It represents great opportunities for collaboration in the fields of research, commerce and education. In particular we will discuss how electronic collaboration is becoming an essential component of business and university life, and how Internet technology is being recognised as a powerful new means to improve the productivity of working groups.*
High-speed communication networks are a powerful tool for promoting successful international partnerships. Using high-speed bandwidth to communicate, collaborative research and development work can be progressed efficiently (without waiting until the next scheduled meeting). This paper illustrates how the authors have gained advantage by exploiting current technology to form successful partnerships in this new, high-speed, 'no boundaries' information age.

Keywords: Internet, high-speed communications, ISDN, European R&D, electronic collaboration.

1. Introduction

Promoting collaboration across national, European and international boundaries is a challenging task. A variety of obstacles including physical distance, national and regional differences in language, business cultures and legal provisions continue to frustrate transnational developments. The key to a successful collaborative project is interactive communication, and the Internet is fast becoming an indispensable international communications tool (Ref 1). In cooperative projects partners often come from different environments, and possibly different regions and countries. Barriers such as geographical remoteness, lack of time in the working day, the cost of travel and differences in culture can seriously hinder regular communication and development work. The exploitation of advanced communication technologies can remove many of these barriers, and the examples of projects made possible through Internet communication are astounding (Ref 2). Internet technology is enabling people in different countries to exchange ideas, develop proposals, advance projects and resolve differences or misunderstandings without ever meeting physically.

Advanced communication tools such as electronic mail, archiving, teleworking, desktop conferencing and interactive video conferencing are becoming cheaper and easier to use (Ref 3). Web technology provides an inexpensive and easy-to-use user interface that is fast becoming a prevalent tool on most desktops. Geographically distant project teams can now plan their programmes of work by remote video conferencing, in which face-to-face discussions can be enhanced by sharing of information held in partners' respective computers. High quality pictures, sound and images can be transmitted over high-speed communication networks to colleagues the other side of the country or the other side of the globe (Ref 4). In effect, broadband communication networks can serve to facilitate communication and collaborative working.

2. The Internet

The 'information superhighway' has been the subject of a great deal of media hype and fanciful speculation. It conjures up a vision of speedy electronic networks, connecting homes and businesses to a boundless trove of information, communication, education and fun. It is predicted to have profound effects on society, the way we communicate with each other and the way we will do business. Trouble is, it isn't here yet, and chances are it will not be a reality for a while.

In the meantime, a forerunner of the information superhighway already exists: it is called the Internet and it is the world's biggest collection of interconnected computer networks. Some people argue that the Internet already is the information superhighway: it simply looks different from the television-based version promoted by the cable and telephone companies. Others say that some important features are missing: the real superhighway will

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combine not just computer networks but all sorts of other communication links, from telephone and radio to satellite (Ref 5). It will be fast where the Internet is slow. Yet the Internet already offers, although in embryonic form, most of the services and technologies that cable and television companies are still a decade from delivering. You can make a telephone call on the Internet; watch a video; listen to an audio broadcast; shop; learn; and of course, communicate. It is a major tool for sharing computer resources, research issues and project ideas, and for communicating with groups and individuals.

The Internet has grown exponentially in recent years and its growth is estimated to be doubling in size and volume on an annual basis, wrapping the world in a massive computer web. At present it connects 30 million users across 130 countries and it is estimated there will be some 100 million users by 1999 (Ref 6). No communications medium or consumer electronics technology has ever grown as quickly: not the fax machine and not even the PC (Ref 5).

3. Electronic pot holes

The Internet is easy to ridicule: it can be chaotic, frustrating and intimidating, and 90% of what is available is rubbish (Ref 5). One of the biggest difficulties that Internet collaborators face is the inherent impersonal nature of the medium. Even with the aid of audio and video conferencing, it is difficult to capture the experience of a face-to-face meeting with a group of colleagues. However it is here to stay, and it will allow people to exercise one of their most basic desires: to communicate (Ref 2). They are able to do this on an unprecedented scale: globally, openly, to one person or many.

4. Superhighway infrastructure

At present the Internet suffers from data speeds that are too slow to move today's multimedia information: 'we have yet to overcome the lack of suitable, high performance, accessible communications infrastructure' (Ref 7). The problem lies with what is commonly referred to as the last mile — the last link between large scale fibre-optic networks (which can be strung along existing rights of way) and customer's homes or businesses. At present this last mile is being bridged by modem technology, which converts digital signals into an analogue format compatible with the traditional telephone (Ref 8). Although modems are widely available at a low cost and are easy to use, they are not able to cope with the increasing demand for bandwidth-hungry applications such as desktop conferencing.

A new infrastructure is underway: within the next decade users will have direct, high-speed connections to the Internet with more effective data transfer rates (Ref 9). A direct connection is one that does not involve ordinary analogue telephone lines with their relatively slow data transfer rates of 1.2 to 28.8 kilobits per second (Ref 6). As we speak a countless number of computers and computer technologies are coming together (linked by high capacity coaxial cable, fibre optics and wireless transmission systems) to create a vast information infrastructure for faster, more efficient information exchange (Ref 8).

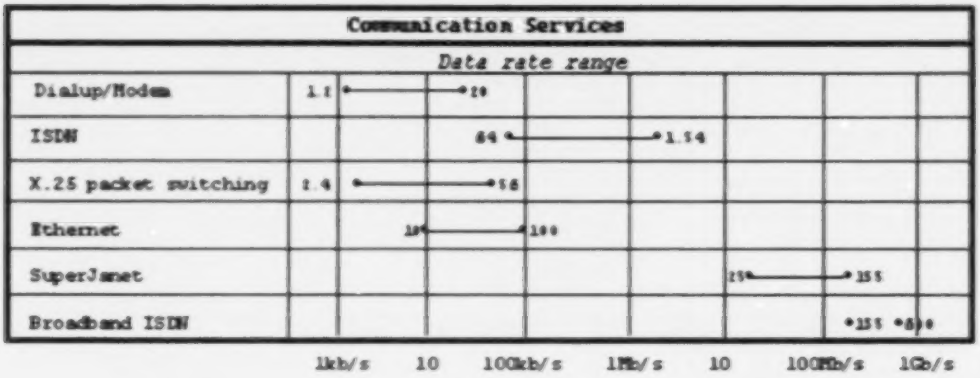
The digitalisation of telephone networks has spawned a new service, ISDN (Integrated Services Digital Network), which allows telephony, e-mail, fax, Internet/Web and full-motion video down a single connection: you get a transmission speed of 64kb per second, roughly five times faster than a standard telephone line with a modem connection (Ref 10). Even so, ISDN has been slow to take off, mainly because for a long time it was ridiculously costly and not widely available. It is only in the last couple of years (in direct correlation with the popularity of the Internet) that individuals have been turning to ISDN as an affordable access vehicle that performs nearly on a par with the expensive dedicated connections of larger organisations (Ref 10).

In competition with the telecommunications industry (ISDN providers) is the TV cable industry, which is constantly digging up the roads and pavements to lay down fibre optic cables. Fibre optic cables carry orders of magnitude more information than their copper base equivalent and the costs of the two are more or less the same (Ref 10). Hence in the not too distant future, both the telecommunications and cable networks will be capable of transporting and processing voice traffic, text and images instantly to and between all households and businesses around the world (Ref 4). This more advanced communications infrastructure has the potential to revolutionise manufacturing, research, education, health and commerce (Ref 11). It will be the medium by which companies will buy, trade, make contacts, exchange data and information, hold conferences, discuss designs and find components (Ref 11).

In the UK this main infrastructure is already in place (for academia) in the form of the SuperJANET broadband network (arguably the world's first superhighway) (Ref 12). SuperJANET is referred to as a WAN or wide area network, since a large geographical area is covered. When talking about site networks we refer to LANs (local area networks), i.e. universities are interconnected to their own departments and campuses through a local area network such as Ethernet. The universally used Ethernet is a high-speed network which currently works at a data transfer rate of 10 Mb/s (see Table 1). Ethernet is compatible with SuperJANET and forms part of the overall network infrastructure. As the name suggests, SuperJANET — the Super Joint Academic Network — is an advanced high-speed optical fibre network linking over 60 universities and research laboratories in the UK (Ref 13). SuperJANET optimally works at a speed of 155 megabits per second. To put this capacity in context, this means that the equivalent of a 5500 page report can be sent in less than one second (Ref 13). High bandwidth networking at these speeds allows the remote use of advanced multimedia technologies hitherto only available

to users on a local basis. SuperJANET is the UK's portion of the global Internet and ultimately it will become part of a global high bandwidth network — an information superhighway which knows no national boundaries (Ref 4).

Table 1: Range of communication services.



5. Economics of the Internet

A simple question that a lot of people ask is: if the Internet runs over telephone lines, why does it cost the same to send an e-mail message around the world as it does to send it next door ? The first reason why long distant messages costs no more than local ones is that the Internet, although it runs on telephone lines, uses them much more economically then voice calls do. A voice call is an analogue signal which needs lots of electronic space to avoid interference: it takes up an entire line for the duration of the call. By contrast the Internet is digital, so data bits — ones and zeros — can be compressed (Ref 14). Secondly, Internet data is split up into packets, which do not need a line to themselves. Packets from hundreds of sources are mixed up by the computer and shoved down the telephone line in a jumble. The router at the other end of the line receives each one, reads its address and sends it in the right direction (Ref 14). When you make a telephone call, you are consuming a scare and expensive resource: a whole line. In comparison when you sending a message on the Internet, you are sharing a plentiful and cheap resource: the entire bandwidth on the line (packets of information are just a drop in a passing river). There is a third reason: telecom pricing is a notorious scam (Ref 14). A large part of the price of a telephone call (often more than 40%) goes to the recipient's telephone company for taking it the last few miles. Through a complicated accounting scheme known as 'settlements', telecom companies exchange billions of pounds each year for the local component of international calls. The Internet bypasses all this: it usually operates on leased lines, out of reach of national telecoms accounting which would find it hard to track and cost a constant stream of ones and zeros.

6. Collaborative working and Internet services

In the case study which will be described, you will be made aware of the various services and applications available on the Internet which enable collaborative working to be carried out. Some of these services are explained here:

- **E-mail**. Electronic mail is by far the most widely used and most basic service available on the Internet. It allows you to send messages to colleagues all the world in a matter of minutes: it is convenient, inexpensive, reliable and fast (Ref 15). In a company or university, an example of everyday use of e-mail is to announce conferences, schedule meetings, arrange appointments between employees and managers, and distribute committee meetings. E-mail is a conduit for sharing hypotheses and results, preparing draft documents and for discussing project issues. The uses of e-mail are endless: in fact it has become an essential tool in most collaborative work and certainly in everyday academic life.
- **File Transfer Protocol (FTP)**. FTP is a useful application that allows you to connect to a host computer and copy some of the host's files to you own computer. FTP provides access to hundreds of gigabytes of programs, text, complex graphics and other miscellany (Ref 16). In collaborative projects this is a useful

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resource where a number of partners in different countries are working on different sections of joint business proposals/reports: they can use FTP to pull the final document together.

- **World Wide Web**. The appeal and success of the ground breaking World Wide Web information service is the driving force behind the explosion in populist use of the Internet. It is by far the best way to retrieve information from the Net and it is already revolutionising the way in which information is accessed and presented. It provides a very user-friendly graphical interface (and hypertext links) to connect you to information on any computer around the world. It supports numerous online services which support collaborative working (see case study).
- **Video conferencing**. Video conferencing is more an application than a service which is supported by the Internet. Video conferencing and desktop conferencing are enabling collaborative groups from different organisations and different countries to have face-to-face meetings without the expense of time and travel. In essence, advanced optical fibre networks help us achieve a rapid and effective meeting of minds without first having to secure a physical meeting of people (Ref 13).

7. Case study: electronic collaboration

The University of Ulster has established a wide range of strategic academic and industrial alliances around the world. This case study describes how research teams at the university are using the Internet to enable these valuable partnerships to be formed.

7.1. Background to European R&D Partnerships

In Europe the Fourth Framework programme provides a major incentive for universities and industry to work together. It supports industrially relevant collaborative research projects by providing direct access to 50% funding. In order to secure funding for European collaborative projects, one has to find partners and subsequently submit a detailed project proposal before the R&D programme deadline (Ref 17). Preparing a proposal involves a substantial investment of time and money, and it is expensive to coordinate the work of a widely spread project team (especially considering the fact than on average only one out of every seven proposals are approved for funding) (Ref 17). Below we will describe a case history which reflects real experiences from a collaborative European project:

7.2. Case study

7.2.1. Step 1: the idea

A small manufacturing company in Sweden needed to implement a shop floor production control system but did not have the expertise. It approached a Research Institute in France with this strategic problem. It was decided to form a consortium and submit a project proposal to the Fourth Framework programme. In order to qualify for EU funding, it is advantageous to have a balanced consortium (of both industrial and academic partners) from about four different EU member states.

7.2.2. Step 2: finding partners

The French partner carried out a partner search using the CORDIS online information service, which is available on the Internet and accessible through the World Wide Web. CORDIS provides a centralised source of information for disseminating, assisting and promoting cooperation on EU R&D projects. It contains details of over 24,000 organisations either seeking or offering themselves as partners for collaborative projects (Ref 18). Fortunately, one of the main research groups at the University of Ulster had submitted a profile of expertise electronically about four months previous. The French and Swedish partners were looking for expertise in scheduling technologies: at this point the University of Ulster was contacted by electronic mail, interest was generated and commitment gained.

7.2.3. Step 3: R&D programme

Further ideas for the project were exchanged using electronic mail. The next step was to find out which Fourth Framework sub-domains the project idea fitted into (i.e. which sub-programme was most likely to fund the project). Again, from a desktop, one can tap into the information database in Brussels and look up information on the various sub-programmes of the Fourth Framework. The appropriate sub-programme was called 'Integration in Manufacturing'. An electronic copy of the programme call and the information package with application form were downloaded from the Internet and printed out. A potential problem arose: there was only two and a half weeks left before the submission deadline. This is when the technology really when into full drive — we had to get at least three more suitable partners on board, write up the project proposal and get it to Brussels before the deadline.

7.2.4. Step 4: networking

'Sweeping across the landscape like a firestorm, the Internet has revolutionised networking' (Ref 19). The University of Ulster group accessed the CORDIS partner search database to look for an industrial end-user partner in either Northern Ireland or the Republic of Ireland. The database came up with several suitable manufacturing companies, which were all contacted and another small electronics manufacturer responded. The French partner used CORDIS again to look for another suitable partner, this time with expertise in database technologies. A French software house joined the team. The consortium was complete. With five partners on board, it was necessary to set up a meeting. We needed to document project objectives, allocate work packages, estimate project costs and human resources, and so on. For one reason or another, two partners could not make the proposed meeting in France: an alternative solution (which saved time and travel) was to have two video conference sessions between France, Sweden and Northern Ireland. The small manufacturing companies from Sweden and Ireland had access to video conference facilities through nearby universities. An agenda and various documents were exchanged electronically (via FTP) before going online. The conference sessions permitted partners to meet face to face, and plan out the project and share ideas, skills and resources over the network rather than in person.

7.2.5. Step 5: Working on proposal

Substantial work on the project proposal was completed in each partner's own country. The Swedish partners became the project leaders and coordinated the compilation of the final proposal. Partners availed of services offered by the Internet to look up state of the art facts. An Internet search was also carried out to verify that the project had not been done before. Using computer-based language translators and interpreters helped common understanding between partners. The French and Swedish partners wanted to set up an electronic brainstorming session. The University of Ulster had used this groupware application on a number of occasions: it enables distributed synchronous information sharing (i.e. activities taking place at the same time in different locations (Ref 20)). It helped us achieve significant productivity, especially during the task of costing the project (where opinions and partner costs varied widely): the brainstorming sessions (using the groupware application) let partners enter comments and ideas simultaneously and anonymously. Within a week, various sections of the project proposal were transferred byte by byte over the Internet to various partners for the purpose of agreeing its content, making changes, and checking it was complete and correct before the final proposal was send to the European Commission. Once submitted, partners continued to communicate on a regular basis using e-mail. Three months later the project leader received notification that the project proposal had been successful and project work has since commenced.

8. Benefits of linking up

Analysing this case history, it would have been impossible to complete the project proposal in time if the partners had not been connected through the global Internet. Partners used e-mail extensively: it was cheap, fast and reliable. At different stages of the proposal writing, FTP was used to transfer the draft proposal from partner to partner: the fact that the document was in electronic form made it easy to edit (imagine 20 years ago having to fax the draft document or send it via snail mail, i.e. regular post). The electronic brainstorming session was crucial in solving decisions regarding estimating costs of the proposed project.

Communicating using advanced technologies significantly reduced the costs of collaborative working. It is estimated that five years ago a transatlantic video conference call (ISDN, single line) cost £800 an hour: now that same call is less than £40 per hour with substantially better quality (Ref 3). Video conferencing improved productivity by reducing time lost to travel and efficiency lost to jet lag. In the case history above, time was the crucial element: it was not possible to get all the partners together at a meeting for the proposed meeting date, but it was possible to get them to meet electronically to implement important project decisions.

9. Conclusion

Electronic technology and high-speed communications are no longer simply aids to collaborative working. In this information era, information that is speedy, accurate and in a form that enables people to make decisions and work productivly together across geographical distances is the key to cost-effective efficient collaboration. The future will offer ever increasing capabilities for electronically enhanced collaborative working. 'Throughout the world, information and communication technologies are generating a new industrial revolution already as significant and far reaching as those of the past . . . This revolution adds huge new capabilities to human intelligence and constitutes a resource which changes the way we work together and live together . . .' (Bangemann Report, Brussels 1994). Failure to meet the challenge of this rapidly expanding information environment will be reflected in failure to survive in the Information economy of the future.

Caroline Grant
Faculty of Informatics
University of Ulster
Co. Londonderry BT48 7JL
Northern Ireland
UK
Tel: +44 (0)1504 375236
Fax: +44 (0)1504 375251
E-mail c.grant@ulst.ac.uk.

References

[1] SPRINT. (1995) Communication in the network. *Good Practice in Managing Transnational Technology Transfer Networks*, **1**, 71–75.

[2] Cranor, L.F. (1995) Internet collaboration: good, bad, and downright ugly, *The Economist*, July issue.

[3] Snell, M. (1994) Picture this: Videoconferencing, *Computer*, **21**, 10–11.

[4] Hartley, D. (1995)Whither the information superhighway, *Computer Bulletin*, **7**(2), 2.

[5] Anderson, C. (1995) The accidental superhighway: a survey of the Internet, *The Economist*, July issue, *http://www.economist.com/surveys/*.

[6] Meltsner, K. (1995) Understanding the Internet: a guide for materials scientists and engineer, *JOM*, **47**(4), 9–10.

[7] Maule, R. (1994). Smart valley infrastructure, *Internet Research*, **4**(2), 48–50.

[8] Jaret, P. (1995) Grabbing a lane on the information highway, *EPRI Journal*, **20**(1), 21–23.

[9] Meltsner, K. (1995) Understanding the Internet, *Journal of Mineral Metals and Material Society*, **47**, 9–13.

[10] Frankel, D. (1995) ISDN reaches the market, *IEEE Spectrum*, June, 20–25

[11] Barthrope, F. (1994) Hitch a ride on the superhighway, *Professional Engineering*, **7**(13), 12–13.

[12] Barden, L. (1995) The university, the superhighway and regional economic development, *Industry & Higher Education*, **9**(5), 315.

[13] UKERNA (1996) What is SuperJANET, *http://www.ukerna.ac.uk*.

[14] Anderson, C. (1995) Freeloading as a way of life: a survey of the Internet, *The Economist*, July issue, *http://www.economist.com/surveys*.

[15] Zelingher, J. (1995) Exploring the Internet, *M.D. Computing*, **12**(2).

[16] Digiorgio and Richert (1994) E-mail, the Internet and information access, *Seminars in Diagnostic Pathology*, **11**, 294–300.

[17] Commission of the European Communities (1994) *EC RTD: Insight into handling of Project Proposals*, pp. 5–9, ISBN 92-826-7076-7.

[18] Commission of the European Communities (1996) CORDIS: online, *Innovation & Technology Transfer*, **1**, 12–13.

[19] Cavallini, A. (1996). Community nets: the next generation, *Computer*, **29**(2), 92.

[20] Palmer *et al.* (1994), Computer-supported co-operative working, *Computer*, **21**, 16.